A slightly revised version of this paper is published as: Williams, C., Fedorowicz, J., Dias, M., Jacobson, D., and Vilviosky, S., Sawyer, S., and Tyworth, M. (2009) "The Formation of Inter-Organizational Information Sharing Networks in Public Safety: Cartographic Insights on Rational Choice and Institutional Explanations," *Information Polity*, 14(1-2), 13-29.

The Formation of Inter-Organizational Information Sharing Networks in Public Safety: Cartographic Insights on Rational Choice and Institutional Explanations

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ABSTRACT

In this article we offer visual depictions and analysis of contextual factors relative to the presence of public safety networks (PSNs) in the United States (U.S.). A PSN combines shared technological infrastructures for supporting information sharing, computing interoperability and interagency interactions involving policing, criminal justice, and emergency response. The broad research objective is to explain the formation of PSNs based upon factors derived from rational choice and institutional theories. To do so we develop maps to represent our data analysis. This analysis suggests that our approach is promising for generating insights about PSNs and, by extension, about other types of inter-organizational collaborations focusing on using information and communication technologies to enable information-sharing.

Keywords

Public safety, e-government, joined-up government, inter-organizational collaboration, information and communication technology, information sharing, rational choice theory, institutional theory.

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1. INTRODUCTION

Public safety is a persistent and increasingly central concern to both policymakers and the public. Catastrophic events such as the September 11th attacks and hurricanes Katrina and Ike concentrate the public's attention and illustrate to policymakers the need for effective public safety agencies capable of preventing and/or responding to such events (Government Accountability Office, 2005; Shelby, 2002; States News Service, 2008). One approach to improving the capabilities of public safety agencies is to develop inter-organizational networks for the sharing of mission-critical information. These public safety networks – or PSNs – are inter-agency collaborations focused on the development and use of information and communication technologies (ICT) to support the information sharing and functional interoperability needs of public safety organizations engaged in law enforcement, criminal justice, and emergency response.

To date, the professional and academic literature is dominated by prescriptive guidance regarding public safety collaborations; advocating particular technological designs, information-sharing arrangements, techniques for getting constituent buy-in, etc. (Bureau of Justice Assistance, 2002; Morton, 2004; National Association of State Chief Information Officers (NASCIO), 2008). Empirical analysis of ongoing PSN formation efforts is largely absent, and no independent comprehensive study of PSNs has been conducted to date. As a result, there is limited knowledge of where or why these PSN initiatives are forming. Through the research reported here we contribute initial empirical and conceptual insight on this question: Why do PSNs form in some places and not others?

This work is motivated by a desire to contribute to improving the conceptual understanding and theoretical development of design principles and parameters for inter-organizational systems (IOS) and, in particular, the type of IOS we are calling PSNs. We aim to provide empirical and conceptual guidance for policing and public safety work, and public-safety infrastructure development more generally. To do this, we draw on two theoretical lenses: rational choice theory and institutional theory. As we detail below, the rational choice perspective focuses attention on agencies' needs for ICT support, the resources required, and the costs of participating in PSN

formation. An institutional perspective, in contrast, focuses attention on the shared values, norms, and regulations that shape PSN formation and the processes by which these elements become shared.

To do this work we draw on the most comprehensive PSN data set yet assembled. We know that PSN collaborations exist at local, state and regional levels in the U.S. and this makes identification of these a difficult task. As detailed below, to date we have compiled a data set containing detailed descriptions of 169 PSNs from a number of secondary sources. Supplementing the PSN data are a corresponding set of contextual data primarily focused on characteristics and descriptors of potentially relevant state-level attributes.

Here we present our initial analysis of these two data sets, using state-by-state maps of PSNs and corresponding state-level contextual data. Through these maps we are able to explore theoretically-driven questions about where PSNs are most likely to occur and why. For example, we mapped the geographic distribution of PSNs in the United States from which we are able to discern patterns of development related to geographical variables such as population, land mass, international borders, and coastlines. The next phase of this work will be to supplement these initial analyses with new primary data that address in more depth issues relative to the governance and technological arrangements of PSNs and indicators of their achieved outcomes and overall success.

The paper continues in five additional sections. In the next section we describe the PSN phenomenon and our motivations for studying their formation. In section three we review rational choice and institutional explanations of PSN formation. We report on our collection and use of secondary data about PSNs and their contexts in section four. In section five we illustrate our preliminary analyses with selected maps; and in section six we show how these analyses may be used for further explorations and theoretical development. We conclude with a discussion of the contributions of our work.

2. WHY STUDY PUBLIC SAFETY NETWORKS

Like other areas of government looking to improve inter-agency collaboration, public safety agencies have begun to set up IOS to support existing and new relationships. We define a PSN as a particular type of IOS that is formed when groups of public sector agencies and private organizations come together to collaborate on issues related to

information-sharing and the concomitant need to develop and share ICT across existing agency/organizational boundaries for the purpose of improving public safety (e.g., NASCIO, 2003). These collaborations vary widely in size and complexity. A particular PSN may involve many organizations or a few; integrate across a single level of government (horizontal integration) or across many levels of government (vertical integration); and can develop complex highly collaborative governance structures or be governed primarily by a single, dominant agency (Gil-Garcia, Schneider, & Pardo, 2004; Sawyer, Fedorowicz, Tyworth, Markus, & Williams, 2007). These PSNs also vary in their integration strategies: some engage in comprehensive integration while others adopt a more selective or more incremental approach (Gil-Garcia et al., 2004).

Interest in, and the formation of, these collaborative arrangements has increased over the past 15 years (Ackroyd, Harper, Hughes, Shapiro, & Soothill, 1992; Manning, 2003; Northrop, Kraemer, & King, 1995; Taylor, Epper, Tolman, & National Institute of Justice (U.S.), 1998). Historically, the federalist system in the US tended to preclude government agencies from collaborating across federal, state and local levels, while top-down and jurisdiction based management models minimized cross-boundary collaboration. The 1990s ushered in a shift to state-administered federal programs, increased state policy initiatives, increased federal and state regulations, fewer and smaller federal assistance programs and a growing web of costly regulations that required agencies to find local public or private organizations with which to partner and share resources. Out of these changes emerged a network management model premised on the interdependence of multiple organizations that collaborate to reach decisions jointly (Agranoff and McGuire, 2001). PSN formation activity has gained additional impetus in the post 9/11 environment (Fedorowicz, Gogan and Williams, 2007). More broadly, PSNs represent an innovative and rapidly diffusing organizational form that combine both the complexity of working with many organizations and reliance on a shared ICT-based infrastructure.

Why would a group of public safety agencies take on such a difficult task? Agencies may choose to collaborate to share information about new technology developments, to achieve the benefits of joint purchasing, to share information processing or business process services, or to develop new technologies for supporting interaction and interoperability among their participating organizations. Here, we confine our analysis to PSNs that have built

shared infrastructures for communication or information processing. In addition, the PSNs we examine are characterized by their objectives to support:

- public safety – criminal justice, emergency management, and or homeland security;
- interagency uses – crossing geographic, functional and/or governmental levels;
- police and their partners – government agencies and private organizations;
- routine operation – such as patrol and criminal investigation, although they also can be used for emergency management or decision support.

The PSNs we study are further characterized by their:

- mixed technology infrastructure – consisting of ICT resources that are both agency-specific, that is, owned by individual agencies, and shared, that is, supporting interoperability and interaction across agencies;
- interagency governance – arrangements for joint policy making and for the management of shared technology resources.

We have identified PSNs in every state, occurring at every level of government: city, metropolitan area, county, state, and regional. For example, the Automated Regional Justice Information System[1] (ARJIS) originated as a mainframe records management system serving the city of San Diego and has grown into a highly collaborative partnership among regional law enforcement agencies serving the entire San Diego metropolitan region. The Pennsylvania Justice Network[2] (JNET) is a state-level PSN that provides assistance to a wide variety of criminal justice agencies throughout Pennsylvania (Sawyer, Tapia, Pesheck, & Davenport, 2004). Chicago's CLEAR system was originally developed to serve the city of Chicago's Police Department and is now being expanded throughout the state of Illinois (Buslik & Maltz, 1999; Skogan et al., 2003). Illinois also has multiple county as

[1] See: http://www.arjis.org/

[2] See: http://www.portal.state.pa.us/portal/server.pt?open=512&objID=1189&mode=2

well as a state level criminal justice information system. Thus PSN formation occurs both within and across geographic boundaries, and in many states multiple PSNs have formed.

3. THEORETICAL PERSPECTIVES ON PSN FORMATION

PSNs are formed in response to many external and internal influences. The contemporary literature on IOS formation makes clear that the public sector context shapes interagency collaboration through such pressures as regulatory requirements for cross-boundary information sharing, gubernatorial or legislative political agenda priorities; demands by the citizenry to address high rates of crime, inefficient court systems, or emergency preparedness and response (Dawes, Pardo and Cresswell, 2004; Fedorowicz, Gelinas, Gogan and Williams, 2008). Funding or procurement restrictions also play a significant role in PSN formation. For example, funds might specifically be offered as incentives to government agencies that can demonstrate "transformational government" progress through dramatically improved offender record management, analysis and reporting. Alternatively, funds might be earmarked for a specific program such as community-oriented policing. These pressures influence how scarce resources are allocated.

Even with a commitment to pursue a PSN, public safety agencies also have highly varied ICT infrastructures in terms of their amount of “legacy” technology, their use of custom developed or COTS (commercial off-the-shelf) software, and the nature of the data collected or shared by participating agencies. Incompatible arrangements of ICT can affect the ability of governmental agencies to join up with others whose ICT is configured differently. Simply: operational issues such as the form and nature of ICT infrastructure often play a strong shaping role in PSN formation.

Given the range of forces acting on PSNs, we argue there are two theoretical perspectives that provide insight into PSN formation – rational choice and institutional. We elaborate on these perspectives below.

3.1 The Rational Choice Perspective

Rational choice theories focus attention on the decisions made by organizations attempting to maximize utility within their environment (Scott, 2004). The premise of the rational choice perspective is that organizational

decision-makers have the ability to systematically identify and then choose best alternatives based on certain criteria (e.g. costs and benefits) to achieve a desired outcome (e.g. improved efficiency). Rational choice theorists view the organization as having control (agency) regarding its future: that is, they are able to operate *on* their environment to a greater extent than the environment influences them. Thus external factors play a secondary role: their presence shapes action by providing evidence, but the organization retains the ability to make decisions it sees as best to reach its desired outcomes.

Relative to PSN formation, rational choice theories hold that agencies make choices about whether to participate in collaborations and what kinds of collaborations to form on the basis of "efficiency" and/or effectiveness concerns such as expected performance improvements (Alexander, 1995; Gil-Garcia, 2005; Ostrom, 1991). From this perspective, key issues for deciding on forming PSNs are: agencies' needs for public safety performance enhancement; the resources required to meet those needs; and the costs of PSN participation or rejection (See Table 1). "Needs" entail demands and requirements placed upon the agency by external organizations and private citizens. "Resources" provide capabilities and raw materials to the agency to meet the demands/requirements placed upon them. "Costs" involve the expenses and barriers of participating in the PSN (including, monetary, human resource time, or equipment allocations).

<insert table 1 here>

States and their governments can differ on all three rational choice dimensions (needs, resources, costs), leading to the expectation that PSN formation will be unequally distributed across states. For example, having a greater population, an international border, or a higher crime rate become "needs" that may lead a state to choose to form a PSN. The rational choice perspective suggests that variations in state's "resources" such as funding, equipment provision, and technological expertise will help predict PSN formations. Likewise, variations in a state's "cost" factors relative to service delivery fees, the form and reliability of the ICT infrastructure, or the need for training, will alter the propensity to form a PSN as an alternative to current approaches to obtaining information.

The three dimensions of the rational choice perspective provide a framework for predicting PSN formation. For example, it may be that the presence of a PSN will be positively related to "needs" factors such as high crime rates

or high population counts, positively related to "resource" factors such as funding levels and sources, and negatively related to "cost" factors such as quality of existing ICT infrastructure. Although the impact of these factors is frequently cited as key to the decision to form an inter-agency collaboration (e.g., Fedorowicz et al., 2007; Fedorowicz, et al, 2008), there has been little to no documented research to characterize the underlying relationship.

Although the rational choice perspective provides researchers with a way to explain how organizational decision-makers evaluate and choose among alternatives, it remains incomplete. Chief among the weaknesses is that rational choice approaches neglect social influences. Actions do not happen in a vacuum but are rather "embedded in concrete, ongoing systems of social relations" (Granovetter, 1985).

3.2 The Institutional Perspective

Organizational scholars have come to view organizations as existing in complex social environments where rationality is challenged by social constructions. Moreover, organizational decision-makers and other actors in organizations respond to the influences and pressures exerted on them by their social environments and, in turn, this limits the organizations' agency. This view of organizations, known collectively as institutional theory, is a powerful tool in its own right that also has been shown to be complementary to rational choice theory (Ostrom, 1991). While there are many variants of institutional theory (Scott, 1987), in general, institutional theories move beyond assumptions of rationality and efficiency to include socially constructed beliefs, norms, and rules and the impact of these social constructions on the behavior of organizations. Meyer and Rowan (1977) argue that organizations do not adopt organizational structures and forms rationally but rather incorporate socially-mediated (institutionalized) structures to achieve legitimacy, and may do so regardless of the impact on efficiency.

DiMaggio and Powell (1983) theorize that organizations became more similar via isomorphic pressures and posit three forms of institutional isomorphism – coercive, mimetic and normative (See Table 2). Coercive isomorphism is the pressure a less-powerful, dependent organization faces from powerful organizations. Specific examples include the pressures felt by an organization to respond to legal and political bodies – such as a PSN needing to respond to HIPAA information-sharing requirements. Mimetic isomorphism is the tendency of an organization to

mimic other organizations – such as the tendency for one police department to have similar structure and procedures as others nearby. Mimetic isomorphism is viewed as one means to respond to uncertainty; in uncertain environments organizations will mimic those organizations seen to be successful. Finally, normative isomorphism articulates the pressures arising from the professionalism that is linked to formal education and professional networks and associations, which is one explanation for the shared belief systems among police officers that Manning (2003) observes. Examples of each of the three sources of pressure are included in Table 2.

<insert table 2 here>

State governments vary relative to both the pressures they face and the ways they respond to these pressures with respect to participation in PSNs (e.g., Korteland & Bekkers, 2007; Toots, 2006). In the case of PSN formation, some states may face coercive pressure in the form of legislative mandates for interagency collaboration or operate under laws and regulations that limit their budgetary discretion (e.g., Weiss, 1987). State rankings or "report cards" on ICT or information management performance as well as knowledge about what other states are doing, particularly neighboring states or states with similar ICT governance arrangements may lead to mimetic behavior promoting or hindering PSN participation. Normative influences may derive from the creation of a professional association dedicated to forming PSNs, the formation of PSN-specific training or the diffusion of a work-force with PSN experience throughout state agencies.

The institutional perspective is premised on the influences of others as shaping behavior. These influences shape, but do not direct or determine what an organization might do. Taking an institutional perspective leads to the expectation that PSNs are more likely to form in states where there are, for example, unfunded demands, poor ICT or information sharing 'report card reports', and where neighboring states have PSNs. One strength of the institutional perspective is that it is premised on the influence of forces external to the actors. This leads to a focus on the larger external environment in which an organization operates as well as the historical influences within that environment, which are important elements to consider when investigating organizations in the historically rich, environmentally complex public sector.

3.3 Complementary Nature of Rational Choice and Institutional Perspectives

While often seen as alternatives, institutional theory and rational choice theory can be complementary in explaining organizational phenomena (Tingling & Parent, 2004; Tolbert, 1985). Specific to digital government research, scholars have argued the importance of analyzing phenomena from multiple theoretical lenses. For example, Gil-Garcia and Pardo (2005) argue that governments must look beyond cost reduction or increased efficiency to consider political, legal and other institutional influences. More specifically, and based on a study of the determinants of governance structure for cross-boundary information sharing in government Pardo, et al. (2008) detail both rational choice and institutional factors.

As applied to PSNs, the rational choice perspective frames agencies as making decisions regarding the formation of a PSN by focusing on needs, resources and costs and that these decisions reflect careful attention to optimizing for efficiency on some set of defined criteria. The institutional perspective, in contrast, is premised on the situated location of agencies where decisions about the formation of a PSN are influenced by ongoing social relations and a complex environment. These decisions are influenced by other organizations and contextual pressures. While powerful on their own, combined, the theories show great promise for improved understanding of PSN formation.

4. DATA: SOURCES, COLLECTION & USE

To explore these theoretical explanations for PSN formation in the United States, we have engaged in an ongoing process of data collection and analysis. We have assembled two large data sets from secondary sources, one comprising indicators of rational choice and institutional factors at the state level, the second comprising published data on individual PSNs. We developed these data sets by gathering and analyzing a wide range of secondary data sources such as reports from governmental and non-governmental agencies, detailed literature reviews, careful attention to announcements in the professional and public press, and through connections to PSN professionals established in prior research.

For each state, we have collected more than 100 different forms of descriptive data about geography, population, public safety organization and funding, political context, and IT governance and performance. For example, we have characterized states in terms of population, population density, land area in square miles, and presence/absence of an international border. Indicators of a state's political climate include the degree of two party

competition, whether the legislature is full or part-time, and the degree of state fiscal dominance relative to local discretionary authority. Organizational attributes include the state's crime rate, homeland security appropriations, expenditures for police protection, number of police protection personnel, and number of law enforcement agencies. Indicators of a state's IT status and performance include the percentage of the IT budget derived from a budget assessment, service fees, and bond issues, and the Government Performance Project Management Report Card for IT. Sources of these data include federal offices such as the Department of Justice and the U.S. Census[3], professional associations such as NASCIO[4], and independent and university-based research centers[5].

Using additional secondary sources, we have identified and captured public information about 169 PSNs. We learned about these collaborations through Web searches of research sites such as SEARCH[6], from federal, state and local Web sites, through newspaper articles, and a wide range of trade press publications[7]. We also attended PSN-oriented conferences and consulted with professionals at government agencies and independent research centers in an attempt to complete our inventory of PSNs across all levels of government. These efforts continue, as new PSNs are announced or begin operations, or as we encounter new sources of information.

One particularly promising approach to analyzing and presenting this large and diverse data set involves the visual display of data by means of maps that can be superimposed to reveal different kinds of relationships, particularly between the incidence of PSNs and presence of various rational choice or institutional factors. This analysis is demonstrated in the following section, in which we focus on the distribution of PSNs in each state in conjunction with state-level indicators for participation in PSNs.

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[3] See http://www.ojp.usdoj.gov/bjs/pubalp2.htm and http://www.census.gov.

[4] See http://www.NASCIO.org.

[5] See for example, http://gpponline.org and http://www.duc.auburn.edu/outreach/cgs/AllDocuments/ASAPLetter.pdf.

[6] http://www.SEARCH.org

[7] See for example, http://www.govtech.com

5. MAPPING PUBLIC SAFETY NETWORKS

In this section we illustrate the qualitative portion of our data analysis strategy by mapping the geographic distribution of PSNs along with some of our state-level contextual data. Maps have been used to illustrate patterns in geographically coded data in many social science domains, including public policy, medical ecology, history and sociology (Ando and Palmer, 1998; Baumont, Ertur and LeGallo, 2004; Gregory, 2000; Kim, Ali, Thiem, Park, von Seidleim, and Clemens, 2008; Siebert, 2000). Here, we use maps to provide a useful tool to understand broad-based patterns among PSN distribution and the rational choice and institutional factors that might explain their formation.

It is not feasible to represent all of the contextual factors we have assembled in our data set here. The maps chosen for inclusion are representative of the categories of rational choice and institutional factors described in the literature review. The illustrative factor maps are then superimposed upon the maps of PSN density to demonstrate the usefulness of this technique.

We begin by presenting a visual depiction of the geographic distribution of PSNs from our data set. Figure 1 graphically depicts state-level PSNs. State-level PSNs are those where the majority of members are state agencies. Similarly, a county, city or metropolitan-area PSN reflects majority membership of similar agencies. Figure 2 combines state PSN counts with existing county, city, or metropolitan-area PSNs, giving the total PSN density by state. Color shading on the map indicates the number of PSNs in each state. (Darker shading means more PSNs.)

<insert figures 1 and 2 here>

To illustrate how the maps will be useful in exploring and visualizing the answers to our research questions, we next present cartographic representations of two “needs”-related (rational choice theory) variables. In this domain, the most general statement of agency needs would be that of enhancing public safety performance. A large population multiplies the number of law abiding citizens who must be protected and law breakers who must be apprehended. It also affects, through the size of the tax base, the resources available to address those needs. A high number of violent crimes presents statistical evidence of a threat that is actual, of a serious type and elevated

level. Figure 3 maps the violent crime rate from the 2004 FBI Uniform Crime Reports. Figure 4 displays population data from the 2000 U.S. Census.

<insert figures 3 and 4 here>

As shown in Figure 3, the crime rate is higher in Southern states and lower in the North Central states. Figure 4 shows that the most densely populous areas are the Northeast, Florida, Texas, Illinois and California. Juxtaposing these two maps, as shown in Figure 5, it becomes apparent that dense population is not a strong indicator of high crime rates, and that in fact some of the least populous states have high rates of crime. This makes clear that there are not direct linkages among rational choice variables: the linkage among rational choice factors is, seemingly, more complex, even though both seem to play a role in the emergence of PSNs.

<insert Figure 5 here>

Mapping crime rate and population over total PSN density (Figures 6 and 7) suggests a relationship between PSN incidence and these two "needs" factors. Visual inspection suggests that PSNs are more frequently located in highly populated areas and those with high violent crime rates. This can be confirmed empirically. A cross-tabulation of the bivariate relationships between PSN categories and crime rate categories yields Tau_b correlation coefficients of +.290 (state level) and +.452 (total number). Between population categories and PSN categories, the coefficients are +.238 (state) and +.474 (total number). A multiple regression model entering both population and crime rate as independent variables explain 66% of the variation in total PSNs (see Table 3).

<insert figures 6 and 7 here>

<insert table 3 here>

We next present three other state attributes that might affect the incidence of PSN formation: state expenditures (2002 data) and state police full-time-equivalents (FTE) (2003 data)[8] reflect state "resources", and the strength of

[8] U.S. Census Bureau, Statistical Abstract of the United States: 2006, Tables 440 and 455 respectively

state governors' institutional powers[9] depicts an institutional measure of potential "coercion". State general expenditures, which are highly correlated with state expenditures in specific categories such as law enforcement and over time, represent budget appropriations within which public agencies must work each year. There generally is little money for unbudgeted expenses and limited flexibility to move budgeted monies into other needs categories. The number of full-time officers delimits the (trained) staffing resources that can be allocated to meeting or enhancing public safety needs. Figures 8, 9 and 10 present these data through map overlays. As shown in Table 4, their relationships with PSN density are of the same magnitude as those for violent crime and population. High multi-collinearity (coefficients greater than .7) precludes entering these variables into a regression model together and/or with population.

<insert figures 8, 9 and 10 here>

6. DISCUSSION

The representations presented here reveal the level of PSN activity in the US and the complex political, economic, social and technological issues that influence their creation and characteristics. The population and crime rate maps are illustrative of a large array of possible overlays. Other factors of interest are given in Tables 1 and 2, which in themselves represent only a fraction of the factors for which we have accumulated state-level data.

The use of maps to depict PSN location provides a useful and simple technique to support the face validity of individual rational choice or institutional factor relationships. The maps we have constructed to date suggest that rational choice provides some insight when compared with PSN density, showing clear links (or lack of links) between needs factors and PSN density, thus suggesting these help predict formation. However, the mapped data suggest that individual institutional factors are not as powerful predictors of PSN location, and should be examined in combination with other explanatory factors. Clearly, more work is needed to understand how to best apply and interpret cartographic techniques.

[9] "Ranking of the Institutional Powers of Governors, 2007" Table 7-2, Thad Beyle and Margaret Ferguson, "Governors and the Executive Branch," in *Politics in the American States*, Ninth Edition, Virginia Gray and Russell L. Hanson, eds. Washington, DC: CQ Press, Forthcoming.

6.1 Data Aggregation and Interpretation Challenges

Our initial representations raise challenging questions about data aggregation and representation. For example, we aggregated violent crime rates by state, but it could be argued that crime is fundamentally a local phenomenon. A public safety initiative may have been formed in response to perceptions that the crime rate was too high in the state or in response to perceptions that the crime rate was too high in a particular county or local area only. Our separation of PSNs by level (state versus local) may be useful in shedding light on such questions.

We know that population and crime are not evenly distributed across geographic and jurisdictional boundaries. This condition is problematic with respect to political influences and power. For example, a city like Chicago may have a high crime rate, while crime rates in the rest of the state remains relatively low. The Illinois legislature has been dominated historically by downstate interests and thus may not respond to a high average crime rate that they see as skewed by the inclusion of the Chicago metropolitan area. Moreover, many parts of Chicago may have low crime rates, or varying rates of particular crimes that may not be considered violent crimes (e.g., drug sales versus domestic abuse); thus, different locations within a region may have very different interests relative to policing and public safety. This means that the formation of PSNs may be a contentious political activity. Future PSN analyses may require more granular analyses, perhaps breaking out county, city and metropolitan area PSNs in addition to those at the state level, or comparative analyses of factors with varying levels of aggregation.

As we conceptualize them, population and crime rates are indications of “needs” for PSNs. However, “needs” can be understood in subjective as well as objective terms. Florida may have one of the highest crime rates in the country, ostensibly favoring PSN formation. However, crime fighting may not have a high political priority in Florida compared with health care, home foreclosures, or environmental management—a situation clearly less favorable for the formation of PSNs. Future work is needed to represent political priorities as an institutional complement to objective, rational choice measures of “needs”.

Predicting PSN formation is complicated by the complexity inherent in the wide range of factors that comprise potential rational choice and institutional theory explanations for their formation. Analysis of these relationships is compounded by the difficulty of acquiring current, complete and usable data about the factors and the PSNs

themselves. The number of potential rational choice and institutional factors that lend themselves to explanation of PSN formation is considerable. High levels of multi-collinearity among many of these factors make it difficult to perform some forms of traditional quantitative analyses.

7. CONCLUSION AND FUTURE RESEARCH

Public safety continues to be a critical concern for all governments, from the local to national levels. Government agencies have long recognized the potential value of sharing information and communicating across agency borders in order to improve their ability to support this important government obligation. Recent advances in ICT, coupled with a willingness to collaborate, have led to innovations in PSNs. PSNs are not found everywhere, nor do they support a common functionality or rely on similar infrastructure. As a result, there is little cataloged knowledge about where PSNs form, and what leads to their formation. This study contributes to our understanding about where PSNs exist and the settings in which they are likely to be found. In addition, the cartographic depiction of their location superimposed with examples of rational choice and institutional factors gives an easily understandable portrayal of the strength of these relationships.

The data mapping activities described above represent one component of a large and ongoing research project. For this effort, data collection has focused mainly on secondary sources which tend to publish quantifiable data that more readily reflects rational choice factors related to needs, resources and costs. However, we are in the process of adding additional primary data by means of interviews with leaders of individual PSNs to obtain additional understanding of the settings in which they reside. These first person accounts will permit analysis based on institutional factors that are not readily accessible through secondary sources, leading to more understanding of what makes PSNs form, and further, the factors that lead to PSN success.

Even at this stage, however, it seems clear that our data and analytic approach is productive in identifying patterns that can help explain the existence and distribution of PSNs. These linkages demonstrate correlation among the factors we analyze, and do not presume any causality between the rational choice and institutional factors and the formation of a PSN. Nevertheless, anecdotal evidence from our research sites corroborates the suggested relationships the maps illustrate in the location and distribution of existing PSNs. In combination with other phases

of our research project, the maps should strengthen our understanding of PSN formation patterns. This shows that both our data sets and our mapping approaches represent a contribution to knowledge about collaborative activity in government in general, and more particularly in public safety contexts and with respect to ICT. Absent the profit motive, understanding what motivates collaboration among government agencies has been of particular interest to those studying public sector policy making (O'Toole and Montjoy, 1984; Bozeman and Bretschneider, 1986).

We note in passing that we significantly underestimated the challenges involved in compiling our data sets. We expected to find, but did not, central repositories of PSN initiatives and common ways of describing their structure, governance, and technological arrangements. We did find a few compilations, such as the survey of communications and information sharing initiatives housed primarily in a local police department conducted by the International Chiefs of Police[10] and a 192-city survey of (communications) interoperability conducted by the United States Conference of Mayors in 2004[11]. However, these inventories have a much more limited focus and scope than ours. We are in the process of setting up a mechanism by which our inventory can be updated to preserve its currency and shared with fellow researchers and PSN developers. This alone, we believe, is an important contribution, to practitioners as well as to academics.

A second contribution lies in our approach to describing and classifying PSNs, only the bare outlines of which we have discussed here. We expected to find, but did not, a clear consensus in the academic or trade literatures on the different types of PSNs or the important bases by which to distinguish them. We have created a wide array of clearly defined PSN descriptors to support future comparative analyses of PSNs and related initiatives in other domains of practice. We believe that this descriptive approach will be useful for other researchers interested in inter-organizational collaboration or in ICT governance and management.

Finally, most studies of interagency collaborations, in the public safety or other domains, rely on single case studies or on a small number of cases (e.g., Fedorowicz, et al, 2007; Sawyer & Tyworth, 2006). Our approach

[10] http://www.iacptechnology.org/TechnologySurveys.html

[11] http://usmayors.org/72ndAnnualMeeting/interoperabilityreport_062804.pdf

attempts to combine the in-depth analysis of richly characterized PSNs with a large sample, if not the entire population of, ICT-related inter-organizational collaborations in the public safety domain. Our characterization is grounded in a strong theoretical base, as presented in this article. By drawing on these rational choice and institutional perspectives, we are able to compile a data set of state attributes that will be useful in analyzing a large variety of public sector inter-organizational collaborations. For these reasons, we expect that our exploration of PSNs will make a useful contribution to the literature on digital government.

Acknowledgements

This work was supported by National Science Foundation grants NSF-0852688 and NSF-0534877. We appreciate the research assistance provided by Bentley students Devin Hilton, Sangsoo Kim, Robert Rizzi, Gaurav Sachdeva, Joanna Scott, and Brian Shea. Portions of this material were first presented in Williams et al, 2008. Comments from reviewers have substantially aided the presentation of the current paper. Special thanks to M. Lynne Markus for her contributions to our work.

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Table 1: Needs, Resources and Costs relative to PSN Formation

Dimension	Examples
Needs	Population Information sharing requirements Crime-rate
Resources	Funding Equipment provision Technological expertise relative to ICT and PSN
Costs	ICT infrastructure Training Changing laws, rules and procedures on information sharing

Table 2: Coercive, Mimetic and Normative Sources of Pressure for PSN Formation

Dimensions	Examples
Coercive	Federal mandate to improve information sharing Powerful agency demands creation of/membership in PSN Funding that is contingent on the formation of a PSN
Mimetic	Other PSNs have received national attention in state rankings or 'report cards' States with PSNs perceived to be 'leaders' Neighboring states with successful PSNs
Normative	Prior collaborative relationships among agencies The creation of a national PSN association Large number of employees and officials with PSN experience

Table 3: Regression results: Total PSNs on violent crime and population

Independent Variables	Standardized Coefficient (Beta)	T (B)	Sig.	R^2	Adjusted R^2
Constant		1.072	.289	.678	.664
Violent Crime	.169	2.022	.049		
Population	.772	9.224	.000		

Table 4: PSN Tau_b Correlation Matrix

	TOTAL PSNs	STATE PSNs	Governor's Power	State Police FTE	State Expenditure	Violent Crime per 100,000
STATE PSNs	681(**)					
Governor's Power	.338(**)	0.123				
State Police FTE	.441(**)	.240(*)	.682(**)			
State Expenditure	.495(**)	.313(**)	.713(**)	.799(**)		
Violent Crime per 100,000	.452(**)	.290(*)	0.236(*)	.469(**)	.376(**)	
Population	.474(**)	0.238(*)	.745(**)	.824(**)	.897(**)	.371(**)

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

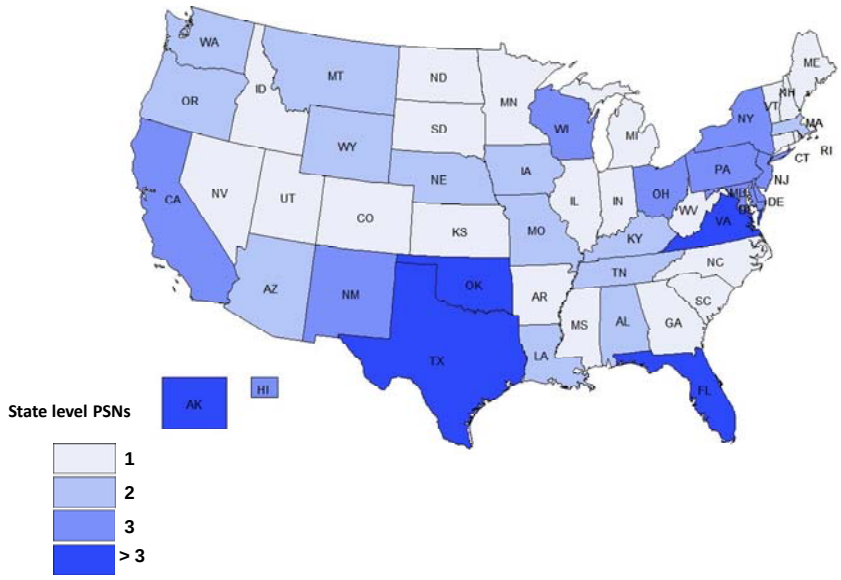

Figure 1: PSN Density by State

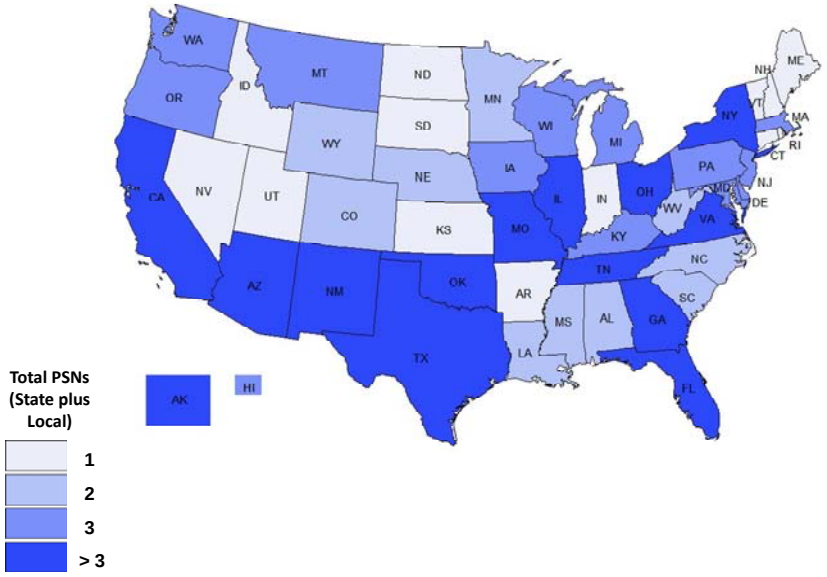

Figure 2: Total PSNs within States (State plus local)

Figure 3: State Violent Crime Rate (FBI Uniform Crime Reports, 2004)

Figure 4: State Population (U.S. Census, 2000)

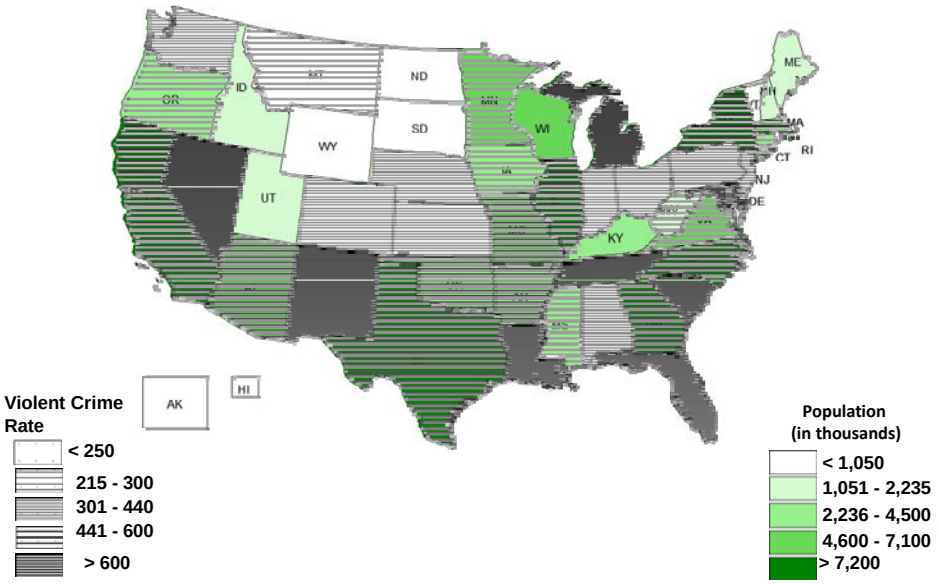

Figure 5: State Population juxtaposed on Violent Crime Rate (compiles Figures 3 and 4)

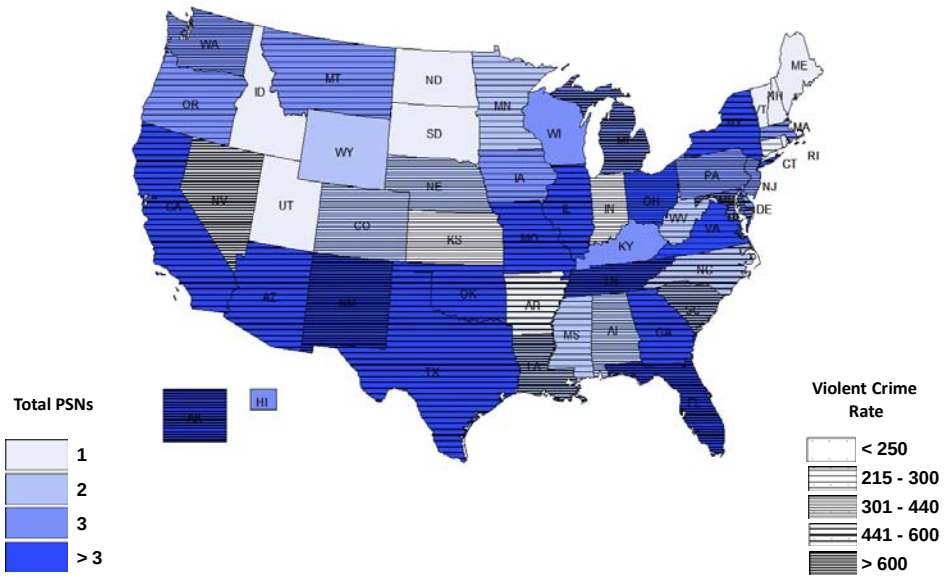

Figure 6: Mapping crime rate over total PSN density (compiles Figures 2 and 3)

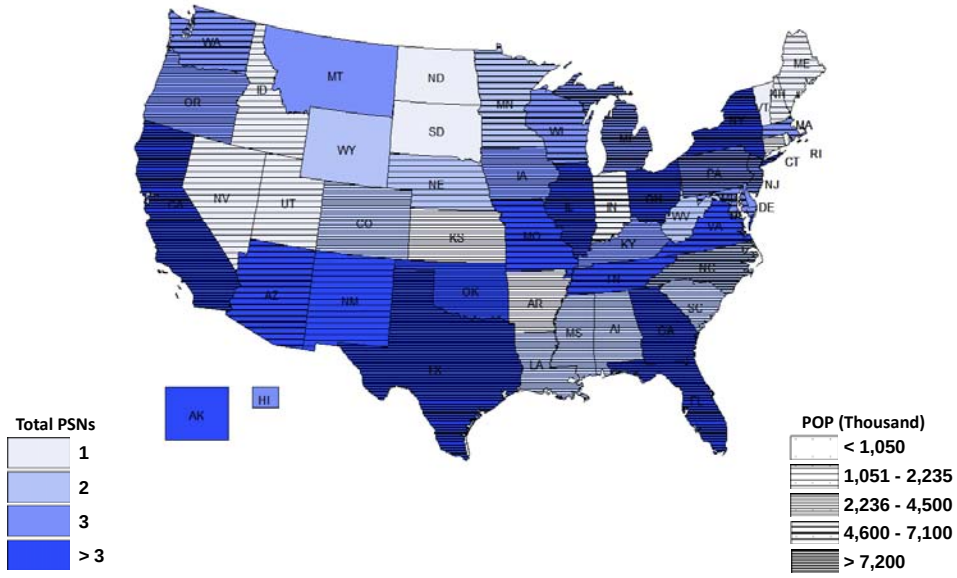

Figure 7: Mapping population over total PSN density (compiles Figures 2 and 4)

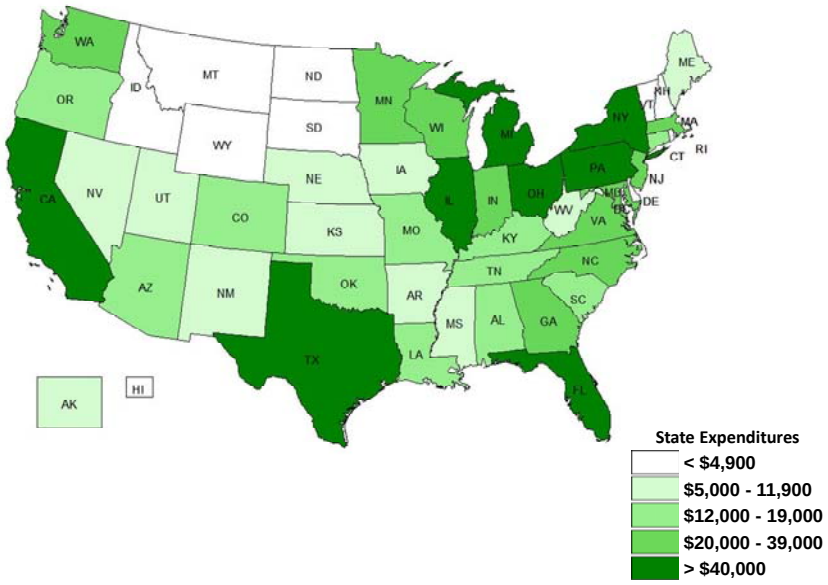

Figure 8: State General Expenditures 2002

(U.S. Census Bureau, Statistical Abstract of the United States: 2006, Table 440)

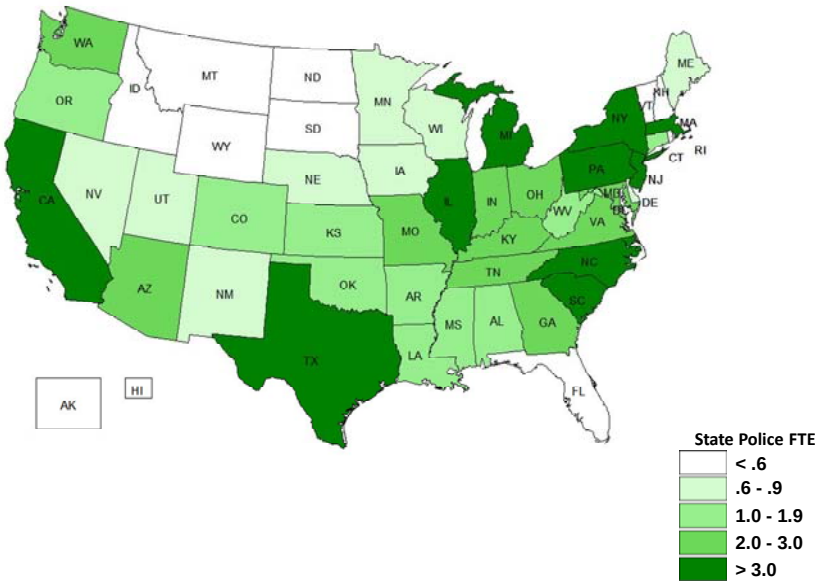

Figure 9: FTE state police 2003

(U.S. Census Bureau, Statistical Abstract of the United States: 2006, Table 455)

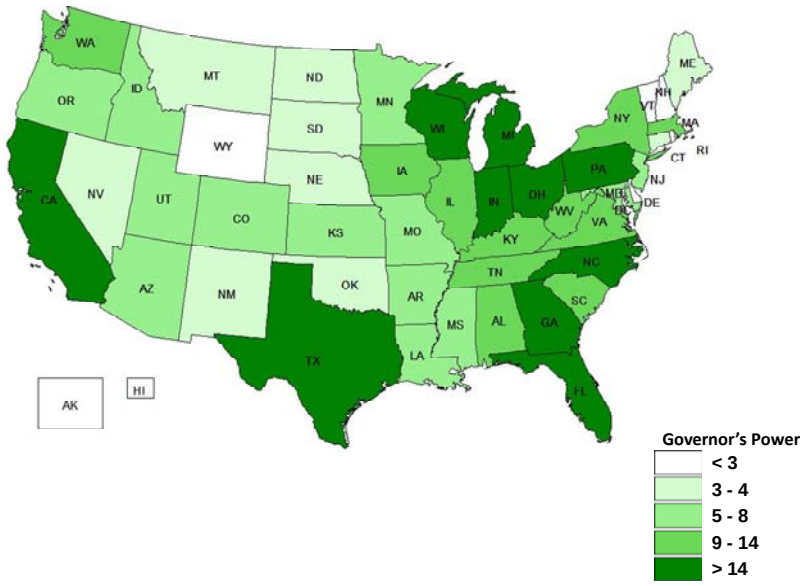

Figure 10: Ranking of the Institutional Powers of Governors
(Thad Beyle and Margaret Ferguson, "Governors and the Executive Branch," Table 7-2) in *Politics in the American States,* Ninth Edition, Virginia Gray and Russell L. Hanson, eds. (Washington, DC: CQ Press, Forthcoming)